No. 200200168

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Michigan State University

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR ORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE PURPOSES, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT D BY THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

POTATO

'Liberator'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the City of Washington, D.C. this twentieth day of September, in the year two thousand and seven.*

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

200200168

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Michigan State University

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME
MSA091-1

3. VARIETY NAME
Liberator

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
109 Agriculture Hall
Michigan State University
East Lansing, MI 48824-1039

5. TELEPHONE *(Include area code)*
517-355-0123

6. FAX *(Include area code)*
517-353-5174

FOR OFFICIAL USE ONLY

PVPO NUMBER
200200168

FILING DATE
06/05/02

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Land Grant University

8. IF INCORPORATED, GIVE STATE OF INCORPORATION
N/A

9. DATE OF INCORPORATION
N/A

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
Dr. David Douches
486 PSSB
Dept. of Crop and Soil Sciences
Michigan State University
East Lansing, MI 48824-1325

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 2705.00
DATE 06/05/02

CERTIFICATION FEE:
$ 768.00
DATE 07/03/2007

11. TELEPHONE *(Include area code)*
517-355-6887

12. FAX *(Include area code)*
517-353-5174

13. E-MAIL
douchesd@msu.edu

14. CROP KIND *(Common Name)*
Potato

15. GENUS AND SPECIES NAME OF CROP
Solanum tuberosum

16. FAMILY NAME *(Botanical)*
Solanum

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ☒ NO

18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)

a. ☒ Exhibit A. Origin and Breeding History of the Variety
b. ☒ Exhibit B. Statement of Distinctness
c. ☒ Exhibit C. Objective Description of Variety
d. ☒ Exhibit D. Additional Description of the Variety *(Optional)*
e. ☒ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ☒ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
g. ☒ Filing and Examination Fee ($2,705), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *See Section 83(a) of the Plant Variety Protection Act)*
☒ YES *(If "yes", answer items 20 and 21 below)* ☒ NO *(If "no", go to item 22)* 06/11/02 JAP LETTER

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES? ☒ YES ☐ NO
IF YES, WHICH CLASSES? ☒ FOUNDATION ☐ REGISTERED ☒ CERTIFIED

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS? ☐ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. [5] FOUNDATION [ ] REGISTERED [5] CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☐ YES ☒ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ☒ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

24. The owners declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER

NAME *(Please print or type)*
Norman M. Pollack, Ph.D.

CAPACITY OR TITLE
Assistant Vice President for Intellectual Property
Michigan State University

DATE
5/10/02

SIGNATURE OF OWNER

NAME *(Please print or type)*

CAPACITY OR TITLE

DATE

S&T-470 (04-01) designed by the Plant Variety Protection Office with WordPerfect 6.0a. Replaces STD-470 (02-99) which is obsolete. *(See reverse for instructions and information collection burden statement)*

INSTRUCTIONS

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), ALL of the following items must be received in the PVPO: (1) Completed application form signed by the owner; (2) completed Exhibits A, B, C, E; (3) at least 2,500 viable untreated seeds, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in a public repository prior to issuance of a certificate; (4) check drawn on a U.S. bank for $2,450 ($300 filing fee and $2,150 examination fee), payable to "Treasurer of the United States" *(See Section 97.175 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 30 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 500, NAL Building, 10301 Baltimore Blvd., Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. DO NOT use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $300 for issuance of the Certificate.

Plant Variety Protection Office
Telephone: (301) 504-5518

#200200168

ITEM

16a. Give: (1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;

(2) the details of subsequent stages of selection and multiplication;

(3) evidence of uniformity and stability; and

(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified.

16b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;

(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences;

(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

16c. Exhibit C forms are available from the PVPO for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

16d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, etc.

16e. Section 52(4) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. The applicant may be the actual breeder, the employee of the breeder, the owner through purchase or inheritance, etc.

17. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant may NOT reverse this affirmative decision after the variety has been sold and so labelled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See P.L. 103-349 for additional information.)*

20. See Sections 41, 42, and 43 of the Act and Section 97.175 of the regulations for eligibility requirements.

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment during the life of the application/certificate. There is no charge for filing a change of address. The fee for filing a change of ownership or assignment is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of Regulations and Rules of Practice.)*

To avoid conflict with other variety names in use, the applicant should check the variety names proposed by contacting: Seed Branch, AMS, USDA, Room 213, Building 306, Beltsville Agricultural Research Center–East, Beltsville, MD 20705. Telephone: (301) 504-8089.

#200200168

'Liberator' Exhibit A

1. Describe the genealogy (back to and including public and commercial varieties, lines, or clones used) and the breeding method(s).

'Liberator' is a new round white chip-processing potato variety (*Solanum tuberosum* L.) developed at Michigan State University with resistance to scab (*Streptomyces scabies* Thaxter). 'Liberator' was evaluated as seedling number MSA091-1. It is a selection from an original cross made in 1988 between the moderately scab resistant breeding line MS702-80 and chip-processing variety Norchip (Johansen et al. 1969) for the purpose of breeding scab resistant chip-processing varieties. The pedigree of 'Liberator' is described below (see attachment).

2. Give the details of subsequent stages of selection and multiplication.

Year	Detail of Stage	Selection Criteria
1988	Seedling generation grown at Michigan State University, East Lansing, MI.	
1989-91	Selection and clonal seed multiplication at Clarksville Horticultural Experiment Station, Clarksville, MI.	Clonal selection at each stage.
1992+	Selection and clonal seed increase at Lake City Experiment Station, Lake City, MI.	
1993+	Replicated agronomic trials at Montcalm Research Farm, Entrican, MI.	Replicated trials.
1993+	Replicated scab disease trials at Michigan State University Soils Farm, East Lansing, MI.	
1995	'Liberator' was placed in to tissue culture.	
1996+	Nuclear seed (tuber) production from tissue culture transplants seed increase.	Seed increase.

3a. Is the variety uniform? __X__Yes _____No

How did you test for uniformity?

'Liberator' was observed for 12 generations in four locations and was determined to be genetically uniform and stable for generation to generation with no evidence of variants. During clonal seed multiplication, the fields are visually inspected each week to identify, virus-infected plants and off-type plants. During this 12-year period of clonal seed multiplication no foliage or tuber variants have been detected.

3b. Is the variety stable? __X___ Yes _____ No

How did you test for stability? Over how many generations?

'Liberator' was observed for 12 generations in four locations and was determined to be genetically uniform and stable for generation to generation with no evidence of variants. During clonal seed multiplication, the fields are visually inspected each week to identify, virus-infected plants and off-type plants. During this 12-year period of clonal seed multiplication no foliage or tuber variants have been detected.

4. Are genetic variants observed or expected during reproduction and multiplication? _____ Yes __X__ No

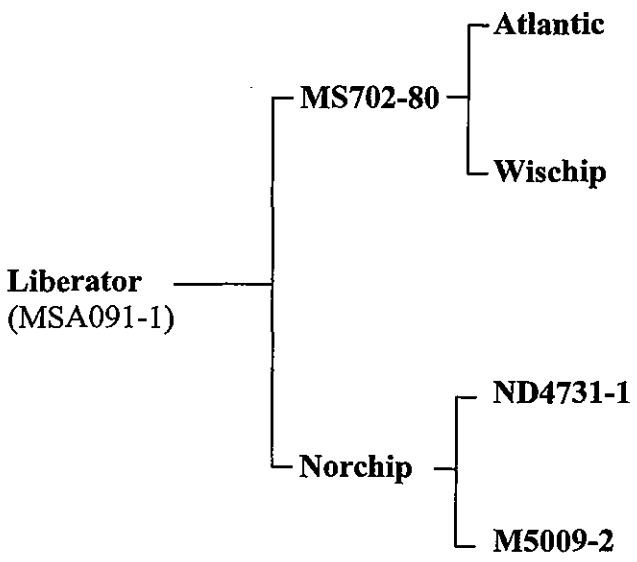
If yes, state how these variants may be identified, their type and frequency.

Continue on additional pages if necessary.

'Liberator' Exhibit A

1. Describe the genealogy (back to and including public and commercial varieties, lines, or clones used) and the breeding method(s).

The pedigree of 'Liberator' is described below:



Johansen, R.H., J.T. Schulz and J.E. Huguelet. 1969. Norchip, A new early maturing chipping variety with high total solids. Amer. Potato J. 46:254-258.

'Liberator' Exhibit B

Based on overall morphology, _'Liberator'_ is most similar to _'Atlantic' and 'Snowden'_.
Applicant's new variety *Most similar comparison variety(ies)*

'Liberator' most clearly differs from _'Atlantic' and 'Snowden'_ in the following traits:
Applicant's new variety *Most similar comparison variety(ies)*

Name the specific trait, then list the value of that trait for each variety in the comparison. Attach appropriate supporting evidence (see the Guidelines for Presenting Evidence in Support of Variety Distinctness, available from the PVP Office or website).

Eg. Terminal leaflet tip shape ***Eg. Corolla inner Color*** ***Eg. NumberEye/Tuber***	***Cuspitate*** ***Violet (85A)*** ***15 +/- 2 (N=100)***	***Obtuse*** ***Red Purple (74B)*** ***30 +/- 4 (N=100)***	***photograph attached*** ***Royal Horticultural Society Colour Chart*** ***statistics attached***
1. Qualitative traits:	Applicant's New Variety: 'Liberator'	1st Comparison Variety: 'Atlantic'	Location of Evidence
Terminal leaflet base shape	Obtuse	Cordate	Exhibit C pg 6.
Primary leaflet base shape	Obtuse	Cordate	Exhibit C pg 6.
Skin texture	Smooth	Netted	Exhibit C pg 8.
Tuber eye depth	Medium-deep (intermediate)	Shallow	Exhibit C pg 10.
2. Color traits:			
Petiole anthocyanin color	Weak	Absent	Exhibit C pg 5.
Corolla inner surface color	Green-white, RHS 157C	Purple, RHS 76C	Exhibit C pg 7.
3. Quantitative traits:			
N/A	N/A	N/A	N/A
4. Other:			
Common scab resistance	Resistant	Susceptible	Exhibit C pg 12 and Table 1 below.
Fingerprinting marker (isozymes)	Unique electrophoretic pattern	Unique electrophoretic pattern	Exhibit C pg 14 and Exhibit C attachment.

Use additional tables to present clear differences for additional comparison varieties. Use additional pages to present supporting evidence.

'Liberator' Exhibit B

Table 1 compares the scab rating of 'Liberator' to some check varieties. Based upon four years of trials, 'Liberator' has resistance to scab that is superior to two chip-processing varieties, 'Atlantic' and 'Snowden,' as determined by Fisher's Least Significant Difference (LSD) at $\alpha = 0.05$.

Table 1. Scab (*Streptomyces scabies*) disease reaction from the Scab Nursery at the Michigan State University Soils Farm, East Lansing, MI.

Entry	1998 [1]	1999 [1]	2000 [2]
Liberator	1.2	1.0	0.6
Atlantic	3.5	3.0	3.3
Snowden	3.2	2.3	2.5
$LSD_{0.05}$	1.6	1.1	0.6

[1]Scab Disease Rating
1: Practically No Infection
2: Low Infection
3: Avg. Susceptibility
4: High Susceptibility
5: Severe Susceptibility

[2]Scab Disease Rating
0: No Infection
1: Low Infection <5%
2: Moderate Susceptibility
3: Intermediate
4: High Susceptibility
5: Severe Susceptibility

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Michigan State University	MSA091-1	Liberator

ADDRESS *(Street and No. or RD No., City, State, Zip Code, and Country)*

109 Agriculture Hall
Michigan State University
East Lansing, MI 48824
USA

PVPO NUMBER

#200200168

REFERENCE VARIETIES: Enter the reference variety name in the appropriate box.

Application Variety (V)	Reference Variety 1 (R1)	Reference Variety 2 (R2)	Reference Variety 3 (R3)	Reference Variety 4 (R4)
Liberator	Atlantic	Snowden	Superior	Yukon Gold

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

1. MARKET CHARACTERISTICS:

***MARKET CLASS:**
1 = Yellow-flesh Tablestock 2 = Round-white Tablestock 3 = Chip-processing 4 = Frozen-processing
5 = Russet Tablestock 6 = Other _____

V	R1	R2	R3	R4
3	3	3	2	1

2. LIGHT SPROUT CHARACTERISTICS: (See Figure 1)

***LIGHT SPROUT: GENERAL SHAPE**
1 = Spherical 2 = Ovoid 3 = Conica 4 = Broad cylindrica 5 = Narrow cylindrical 6 = Other _____

V	R1	R2	R3	R4
1	4	No Data	No Data	2

***LIGHT SPROUT BASE: PUBESCENCE OF TIP**
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
3	2	No Data	No Data	3

***LIGHT SPROUT BASE: ANTHOCYANIN COLORATION**
1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

V	R1	R2	R3	R4
2	2	No Data	No Data	2

***LIGHT SPROUT BASE: INTENSITY OF ANTHOCYANIN COLORATION (IF PRESENT)**
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
5	4	No Data	No Data	5

***LIGHT SPROUT TIP: HABIT**
1 = Closed 2 = Intermediate 3 = Open

V	R1	R2	R3	R4
1	1	No Data	No Data	1

2. LIGHT SPROUT CHARACTERISTICS: (continued)

LIGHT SPROUT TIP: PUBESCENCE
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
3	2	No Data	No Data	2

LIGHT SPROUT TIP ANTHOCYANIN COLORATION
1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

V	R1	R2	R3	R4
1	1	No Data	No Data	1

LIGHT SPROUT TIP: INTENSITY OF ANTHOCANIN COLORATION (IF PRESENT)
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
1	1	No Data	No Data	2

LIGHT SPROUT ROOT INITIALS: FREQUENCY
1 = Short 2 = Medium 3 = Long

V	R1	R2	R3	R4
1	1	No Data	No Data	1

3. PLANT CHARACTERISTICS:

GROWTH HABIT: (See Figure 2)
3 = Erect (>45° with ground) 5 = Semi-erect (30-45° with ground) 7 = Spreading

V	R1	R2	R3	R4
5	4	5	4	3

TYPE:
1 = Stem (foliage open, stems clearly visible) 2 = Intermediate 3 = Leaf (Foliage closed, stems hardly visible)

V	R1	R2	R3	R4
2	2	3	2	2

MATURITY: Days after planting (DAP) at vine senescence

V	R1	R2	R3	R4
128	120	140	110	120

PLANTING DATE:

V	R1	R2	R3	R4
5/2/2000	5/2/2000	5/2/2000	5/2/2000	5/2/2000

***REGIONAL AREA:**
1 = Pacific North West (WA, OR, ID, CO, CA) 2 = North Central (ND, WI, MI, MN, OH) 3 = North East (ME, NY, PA, NJ, MD, MA, RI,)
4 = Mid-Atlantic Erect (VI, NC, SC, South NJ, FL) 5 = South (LA, TX, AZ, NE) 6 = Canada
7 = Europe 8 = England 9 = Latin America 10 = Brazil 11 = Other _____

V	R1	R2	R3	R4
2	2	2	2	2

MATURITY CLASS:
1 = Very Early (<100 DAP) 2 = Early (100-110 DAP) 3 = Mid-season (111-120 DAP) 4 = Late (121-130 DAP) 5 = Very Late (>130 DAP).

V	R1	R2	R3	R4
4	3	5	2	2

4. STEM CHARACTERISTICS: Measure at early first bloom

*** STEM ANTHOCYANIN COLORATION:**
1 = Absent 3= Weak 5 = Medium 7 = Strong 9 = Very Strong

V	3	R1	3	R2	1	R3	1	R4	5

STEM WINGS: (See Figure 3)
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong

V	3	R1	5	R2	4	R3	3	R4	5

5. LEAF CHARACTERISTICS:

LEAF COLOR: *(Observe fully developed leaves located on middle 1/3 of plant)*
1 = Yellowing-green 2 = Olive-green 3 = Medium Green 4 = Dark Green 5 = Grey-green 6 = Other _____

V	1	R1	3	R2	1	R3	3	R4	3

LEAF COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsell Color Chart
(Observe fully developed leaves located on middle 1/3 of plant and circle the appropriate color chart)

V	137B	R1	137B	R2	147A	R3	137A	R4	137A

LEAF PUBESCENCE DENSITY:
1 = Absent 2 = Sparse 3 = Medium 4 = Thick 5 = Heavy

V	3	R1	3	R2	3	R3	3	R4	3

LEAF PUBESCENCE LENGTH:
1 = None 2 = Short 3 = Medium 4 = Long 5 = Very Long

V	2	R1	2	R2	2	R3	2	R4	2

(Note Descriptor #15 can be used to describe the type and length of the glandular trichomes observed.)

*** LEAF SILHOUETTE:** (See Figure 4)
1 = Closed 3 = Medium 5 = Open

V	3	R1	3	R2	4	R3	5	R4	4

PETIOLES ANTHOCYANIN COLORATION:
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong

V	3	R1	1	R2	1	R3	2	R4	2

LEAF STIPULES SIZE: (Se Figure 5)
1 = Absent 3 = Small 5 = Medium 7 = Large

V	5	R1	5	R2	6	R3	5	R4	7

TERMINAL LEAFLET SHAPE (See Figures 6 and 7)
1 = Narrowly ovate 2 = Medium Ovate 3 = Broadly Ovate 4 = Lanceolate 5 = Elliptical 6 = Obovate 7 = Oblong 8 = Other _____

V	2	R1	2	R2	2	R3	3	R4	4

5. **LEAF CHARACTERISTICS:** (continued)

TERMINAL LEAFLET TIP SHAPE: (See Figures 6 and 8)
1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____

V	3	R1	3	R2	3	R3	3	R4	3

* **TERMINAL LEAFLET BASE SHAPE:** (See Figure 9)
1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____

V	3	R1	4	R2	4	R3	4	R4	1

TERMINAL LEAFLET MARGIN WAVINESS:
1 = Absent 2 = Slight 3 = Weak 4 = Medium 5 = Strong

V	2	R1	3	R2	4	R3	3	R4	2

NUMBER OF PRIMARY LEAFLET PAIRS: (See Figure 6)

AVERAGE:

V	4	R1	4	R2	4	R3	4	R4	5

RANGE:

V	3 to 5	R1	4 to 5	R2	3 to 5	R3	3 to 5	R4	4 to 6

PRIMARY LEAFLET TIP SHAPE: (See Figures 6 and 8)
1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____

V	3	R1	3	R2	3	R3	3	R4	3

PRIMARY LEAFLET SIZE:
1 = Very Small 2 = Small 3 = Medium 4 = Large 5 = Very Large

V	No Data	R1	No Data	R2	No Data	R3	No Data	R4	No Data

PRIMARY LEAFLET SHAPE: (See Figures 6 and 7)
1 = Narrowly ovate 2 = Medium ovate 3 = Broadly ovate 4 = Lanceolate 5 = Elliptical 6 = Ovate 7 = Oblong 8 = Other _____

V	1	R1	1	R2	1	R3	2	R4	1

PRIMARY LEAFLET BASE SHAPE: (See Figures 6 and 9)
1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____

V	3	R1	4	R2	4	R3	4	R4	3

NUMBER OF SECONDARY AND TERTIARY LEAFLET PAIRS: (See Figure 6)

AVERAGE:

V	4	R1	4	R2	2.8	R3	6	R4	8

RANGE:

V	2 to 8	R1	3 to 8	R2	2 to 3	R3	2 to 7	R4	5 to 10

5. **LEAF CHARACTERISTICS:** (continued)

NUMBER OF INFLORESCENCE/PLANT:

AVERAGE:

V	16	R1	16	R2	10	R3	7	R4	9

RANGE:

V	12 to 18	R1	7 to 22	R2	4 to 17	R3	4 to 12	R4	7 to 11

NUMBER OF FLORETS/INFLORESCENCE:

AVERAGE:

V	18	R1	12	R2	8	R3	12	R4	10

RANGE:

V	11 to 25	R1	9 to 16	R2	6 to 12	R3	7 to 14	R4	8 to 17

*** COROLLA INNER SURFACE COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)

V	157C	R1	76C	R2	157D	R3	84B	R4	85C

*** COROLLA OUTER SURFACE COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)

V	157C	R1	76C	R2	157D	R3	84B	R4	85C

*** COROLLA INNER SURFACE COLOR:** (Measure predominant color of newly open flower, if flowers are bi-color please use the ratio codes)
1 = White 2 = Red-violet 3 = Blue-violet 4 = Cream 5 = Red-purple 6 = Blue 7 = Pink 8 = Pink-white 9 = Purple 10 = Violet 11 = Purple-violet 13 = Violet-White 1:1 14 = Violet-White 1:3 15 = Violet-White 3:1 16 = Violet-White Halo 17 = Pink-White 1:1 18 = Pink-White 1:3 19 = Pink-White 3:1 20 = Pink-White Halo 21 = RedViolet-White 1:1 22 = RedViolet-White 1:3 23 = RedViolet-White 3:1 24 = RedViolet-White Halo 25 = BlueViolet-White 1:1 26 = BlueViolet-White 1:3 27 = BlueViolet-White 3:1 28 = BlueViolet-White Halo
12 = Other _____

V	1	R1	9	R2	1	R3	10	R4	10

COROLLA SHAPE: (See Figure 10)
1 = Very rotate 2 = Rotate 3 = Pentagonal 4 = Semi-stellate 5 = Stellate

V	4	R1	3	R2	4	R3	4	R4	3

6. **INFLORESCENCE CHARACTERISTICS:**

CALYX ANTHOCYANIN COLORATION:
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very strong

V	1	R1	2	R2	2	R3	3	R4	5

ANTHER COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsel Color Chart (Measure when newly opened flower is fully expanded and circle the appropriate color chart)

V	17C	R1	12A	R2	17C	R3	14B	R4	17B

ANTHER SHAPE: (See Figure 11)
1 = Broad cone 2 = Narrow cone 3 = Pear-shaped cone 4 = Loose 5 = Other

V	2	R1	1	R2	1	R3	2	R4	1

6. INFLORESCENCE CHARACTERISTICS: (continued)

POLLEN PRODUCTION:
1 = None 3 = Some 5 = Abundant

V	5	R1	3	R2	1	R3	3	R4	2

STIGMA SHAPE: (See Figure 12)
1 = Capitate 2 = Clavate 3 Bi-lobed

V	1	R1	1	R2	1	R3	1	R4	1

STIGMA COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsel Color Chart (Circle the appropriate color chart)

V	146C	R1	146C	R2	146B	R3	137C	R4	137C

BERRY PRODUCTION: (Under field conditions)
1 = Absent 3 = Low 5 = Moderate 7 = Heavy 9 = Very Heavy

V	7	R1	3	R2	1	R3	2	R4	2

7. TUBER CHARACTERISTICS:

*** PREDOMINANT SKIN COLOR:**
1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
10 = Purple 11 = Dark purple-black 12 = Other _____

V	4	R1	5	R2	4	R3	5	R4	3

PREDOMINANT SKIN COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsell Color Chart (Circle the appropriate color chart)

V	162C	R1	162A	R2	164B	R3	162A	R4	162C

SECONDARY SKIN COLOR:
1 = Absent 2 = Present (please describe)

V	1	R1	1	R2	1	R3	1	R4	2

SECONDARY SKIN COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsell Color Chart (Circle the appropriate color)

V	N/A	R1	N/A	R2	N/A	R3	N/A	R4	54C

SECONDARY SKIN COLOR DISTRIBUTION: (See Figure 13)
1 = Eyes 2 = Eyebrows 3 = Splashed 4 = Scattered 5 = Spectacled 6 = Stippled 7 = Other _____

V	N/A	R1	N/A	R2	N/A	R3	N/A	R4	N/A

SKIN TEXTURE:
1 = Smooth 2 = Rough (flaky) 3 = Netted 4 = Russetted 5 = Heavily russetted 6 = Other _____

V	1	R1	3	R2	3	R3	3	R4	1

7. **TUBER CHARACTERISTICS:** (continued)

* **TUBER SHAPE:** (See Figure 14)
1 = Compressed 2 = Round 3 = Oval 4 = Oblong 5 = Long 6 = Other _____

V	1	R1	2	R2	1	R3	2	R4	2

TUBER THICKNESS:
1 = Round 2 = Medium thick 3 = Slightly flattened 4 = Flattened 5 = Other _____

V	3	R1	2	R2	2	R3	2	R4	1

TUBER LENGTH (mm):

AVERAGE:

V	79	R1	78	R2	70	R3	86	R4	74

RANGE:

V	60 to 96	R1	65 to 100	R2	54 to 100	R3	60 to 125	R4	62 to 90

STANDARD DEVIATION:

V	11	R1	11	R2	15	R3	13	R4	8

AVERAGE WEIGHT OF SAMPLE TAKEN:

V	191 g	R1	233 g	R2	181 g	R3	170 g	R4	185 g

TUBER WIDTH (mm)

AVERAGE:

V	69	R1	74	R2	67	R3	62	R4	69

RANGE:

V	56 to 81	R1	63 to 82	R2	54 to 83	R3	48 to 81	R4	58 to 79

STANDARD DEVIATION:

V	6	R1	5	R2	7	R3	6	R4	7

AVERAGE WEIGHT OF SAMPLE TAKEN (g):

V	191 g	R1	233 g	R2	181 g	R3	170 g	R4	185 g

7. TUBER CHARACTERISTICS: (continued)

TUBER THICKNESS (mm):

AVERAGE:

V	55	R1	61	R2	54	R3	53	R4	57

RANGE:

V	46 to 68	R1	52 to 80	R2	48 to 64	R3	43 to 60	R4	48 to 63

STANDARD DEVIATION:

V	6	R1	7	R2	7	R3	4	R4	6

AVERAGE WEIGHT OF SAMPLE TAKEN (g):

V	191 g	R1	233 g	R2	181 g	R3	170 g	R4	185 g

TUBER EYE DEPTH:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

V	3	R1	2	R2	3	R3	3	R4	2

TUBER LATERAL EYES:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

V	3	R1	2	R2	3	R3	3	R4	2

NUMBER EYE/TUBER:

AVERAGE:

V	10.7	R1	8.1	R2	8.9	R3	11.3	R4	8.0

RANGE:

V	8 to 15	R1	6 to 10	R2	6 to 12	R3	7 to 16	R4	6 to 10

DISTRIBUTION OF TUBER EYES:

1 = Predominantly apical 2 = Evenly distributed

V	2	R1	2	R2	2	R3	2	R4	2

PROMINENCE OF TUBER EYEBROWS:

1= Absent 2 = Slight prominence 3 = Medium prominence 4 = Very prominent 5 = Other _____

V	2	R1	1	R2	3	R3	3	R4	2

7. **TUBER CHARACTERISTICS:** (continued)

PREDOMINANT TUBER FLESH COLOR
1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
10 = Purple 11 = Dark purple-black 12 = Other _____

V	1	R1	1	R2	1	R3	1	R4	3

PRIMARY TUBER FLESH COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)

V	11D	R1	13D	R2	10D	R3	10D	R4	10B

SECONDARY TUBER FLESH COLOR:

1 = Absent 2 = Present, please describe: _____

V	1	R1	1	R2	1	R3	1	R4	1

SECONDARY TUBER FLESH COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)

V	N/A	R1	N/A	R2	N/A	R3	N/A	R4	N/A

NUMBER OF TUBERS/PLANT:
1 = Low (<8) 2 = Medium (8-15) 3 = High (>15)

V	2	R1	2	R2	3	R3	2	R4	1

8. DISEASES CHARACTERISTICS:

DISEASES REACTION: 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lessions in Number and Size 4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible 7 = Susceptible 9 = Highly Susceptible

LATE BLIGHT: (Phytophthora)

V	5	R1	7	R2	7	R3	7	R4	7

EARLY BLIGHT: (Alternaria)

V	0	R1	0	R2	0	R3	0	R4	0

SOFT ROT (Erwinia)

V	0	R1	0	R2	0	R3	0	R4	0

COMMON SCAB (Streptomyces)

V	1	R1	7	R2	7	R3	2	R4	5

POWDERY SCAB (Spongospora)

V	0	R1	0	R2	0	R3	0	R4	0

DRY ROT (Fusarium)

V	0	R1	0	R2	0	R3	0	R4	0

POTATO LEAF ROLL VIRUS (PLRV)

V	0	R1	0	R2	0	R3	0	R4	0

8. DISEASES CHARACTERISTICS: (continued)

POTATO VIRUS X (PVX)

V	0	R1	0	R2	0	R3	0	R4	0

POTATO VIRUS Y (PVY)

V	0	R1	0	R2	0	R3	0	R4	0

POTATO VIRUS M (PVM)

V	0	R1	0	R2	0	R3	0	R4	0

POTATO VIRUS A (PVA)

V	0	R1	0	R2	0	R3	0	R4	0

GOLDEN NEMATODE (Globodera)

V	0	R1	0	R2	0	R3	0	R4	0

ROOT – KNOT NEMATODE (Meloidogyne)

V	0	R1	0	R2	0	R3	0	R4	0

OTHER DISEASE _____

V	0	R1	0	R2	0	R3	0	R4	0

PHYSIOLOGICAL DISORDER

1 = Malformed shape 2 = Tuber cracking 3 = Feathering 4 = Hollow heart 5 = Internal necrosis
6 = Blackheart 7 = Internal sprouting 8 = Other _____

V	N/A	R1	N/A	R2	N/A	R3	N/A	R4	N/A

9. PESTS CHARACTERISTICS:

PEST REACTION: 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lessions in Number and Size
4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible
7 = Susceptible 9 = Highly Susceptible

COLORADO POTATO BEETLE (CPB) (*Leptinotarsa*)

V	0	R1	0	R2	0	R3	0	R4	0

GREEN PEACH APHID (*Myzus*)

V	0	R1	0	R2	0	R3	0	R4	0

OTHER:

V	0	R1	0	R2	0	R3	0	R4	0

OTHER:

V	0	R1	0	R2	0	R3	0	R4	0

10. GENE TRAITS:

INSERTION OF GENES: 1 = YES 2 = NO [2]

IF YES, describe the gene(s) introduced or attach information:

11. QUALITY CHARACTERISTICS:

CHIEF MARKET:

SPECIFIC GRAVITY (wt. air/wt. air – wt. water)
1 = <1.060 2 = 1.060-1.069 3 = 1.070-1.079 4 = 1.080-1.089 5 = >1.090

V	4	R1	4	R2	4	R3	3	R4	3

TOTAL GLYCOALKALOID CONTENT (mg./100 g. fresh tuber)

V	4.6	R1	10.0	R2	15.0	R3	No Data	R4	No Data

OTHER QUALITY CHARACTERISTICS: Describe any other quality characteristics that may aid in identification, (e.g., chip-processing, french fry processing, baking, boiling, after-cooking darkening). Please attach data and corresponding protocol.

No additional data.

12. CHEMICAL IDENTIFICATION:

Describe chemical traits of the candidate variety that aid in its identification (e.g., protien or DSN electrophoresis). Please attach data and the corresponding protocol.

No additional data.

13. FINGER PRINTING MARKERS:

ISOZYMES 1 = YES 2 = NO [1]

IF YES, attach information See attachment.

14. DNA PROFILE: 1 = YES 2 = NO [2]

IF YES, attach information

15. ADDDITIONAL COMMENTS AND CHARACTERISTICS:

Include any additional descriptors that would be useful in distringuishing the candidate variety.

No additional comments.

'Liberator' Exhibit C – Additional Information

13. Fingerprinting Markers: Isozymes.

Electrophoretic Patterns

Leaf tissue was sampled from 'Liberator' to construct an electrophoretic fingerprint. The procedures and allelic designations used are according to Douches and Ludlam (1991). The transcript for ten enzyme loci is described below:

Mdh-$1^2 1^2 1^2 1^4$, Mdh-$2^2 2^2 2^2 2^2$, 6-Pgdh-$3^1 3^1 3^2 3^2$, Idh-$1^1 1^2 1^2 1^2$, Pgi-$1^2 1^2 1^2 1^4$, Got-$1^3 1^3 1^4 1^4$,

Got-$2^3 2^3 2^5 2^5$, Pgm-$1^1 1^1 1^1 1^2$, Pgm-$2^2 2^2 2^2 2^3$, Dia-$1^1 1^1 1^1 1^2$.

This electrophoretic data is maintained as part of a database with over 200 lines and varieties. The electrophoretic fingerprint is unique to 'Liberator.'

Douches, D.S. and K. Ludlam. 1991. Electrophoretic characterization of North American potato varieties. Am. Potato J. 68: 767-780.

#200200168

'Liberator' Exhibit D

Optional supporting information for 'Liberator' can be found in the attached reprint from the peer-reviewed journal article supporting the release of this variety:

Douches, D.S., K. Jastrzebski, J. Coombs, R.W. Chase, R. Hammerschmidt, and W.W. Kirk. 2001. Liberator: A Round White Chip-processing Variety with Resistance to Scab. Amer. J. Potato Res. 78(6): 425-431.

Liberator: A Round White Chip-processing Variety with Resistance to Scab

D. S. Douches[1]*, K. Jastrzebski[1], J. Coombs[1], R. W. Chase[1], R. Hammerschmidt[2], and W. W. Kirk[2]

[1]Dept. of Crop and Soil Sciences, Michigan State University, E. Lansing, MI 48824.
[2]Dept. of Botany and Plant Pathology, Michigan State University, E. Lansing, MI 48824.
*Corresponding author: David S. Douches, Phone: 517-353-3145; FAX 517-353-5174; douchesd@msu.edu

ABSTRACT

Liberator is a round white chip-processing selection with medium-high specific gravity and resistance to scab (*Streptomyces scabies* Thaxter). The tubers will chip process out of the field and from 10 C storage. The tuber appearance is similar to Norchip. Post-harvest tuber tests indicate a tolerance to fusarium dry rot. Liberator was tested in the North Central Regional Trials and the National Snack Food Association Trials. Under irrigated conditions the yield and specific gravity are similar to Snowden and Atlantic. Liberator has a full-season vine maturity that is similar to Snowden and tuber dormancy equal to Atlantic.

RESUMEN

Liberator es una variedad de papa de tubérculos redondos y blancos para procesamiento; tiene de mediana a alta gravedad específica y es resistente a la sarna (*Streptomyces scabies* Thaxter). Los tubérculos pueden ser procesados para chips inmediatamente despues de ser cosechados o despues de ser almacenados a 10 C. La aparencia de los tubérculos es similar a la variedad Norchip. Los tubérculos recién cosechados son resistentes a la pudrición por fusarium. Liberator fue evaluado en experimentos de la Region Central Norte de los Estados Unidos y por la Asociación Nacional de Snack Food. Esta variedad posee un alto rendimiento y una gravedad específica similar a Snowden y Atlantic en cultivo irrigado. Tiene también maduración media tardía, similar a Snowden, y dormancia equivalente a Atlantic.

Accepted for publication August 2, 2001.
ADDITIONAL KEY WORDS: *Solanum tuberosum*, potato, *Streptomyces scabies*.

BACKGROUND

Liberator is a new round white chip-processing potato variety (*Solanum tuberosum* L.) developed at Michigan State University with resistance to scab (*Streptomyces scabies* Thaxter). Liberator was evaluated as seedling number MSA091-1. It is a selection from a cross made in 1988 between the moderately scab-resistant breeding line MS702-80 and chip-processing variety Norchip (Johansen et al. 1969) for the purpose of breeding scab-resistant chip-processing varieties. The name Liberator was chosen to acknowledge the resistance to scab in this round white chip-processing variety.

Liberator is a round white chip-processing variety with a medium set of bright-skinned tubers similar in appearance to Norchip (Figure 1). The tubers have a low level of internal defects. The primary strength of this variety is its strong resistance to scab combined with chip-processing quality. Another strength of Liberator is that the tubers have a level tolerance to fusarium dry rot similar to Snowden. Liberator was tested in the North Central Regional Trials and the National Snack Food Association Trials. Under irrigated conditions, the yield and specific gravity are similar to Snowden and Atlantic with vine maturity similar to Snowden. The pedigree of Liberator is described in Figure 2.

The seedling generation was grown in 1988, followed by two years of selection and seed multiplication at the Clarksville Horticultural Experiment Station, Clarksville, MI. Since 1992, seed increase was relocated to the Lake City Experiment Station. Since 1993, Liberator has been tested in replicated agronomic trials at the Montcalm Research Farm, Entrican, MI, and in the scab nursery at the Michigan State University Soils Farm, East Lansing, MI. In 1997 it was entered into farm trials in Michigan, and then in 1999 was placed into commercial seed production.

VARIETAL DESCRIPTION

Plant Vine and Foliage: *Growth habit*: Medium to tall height, spreading with a balance between stems and foliage vis-

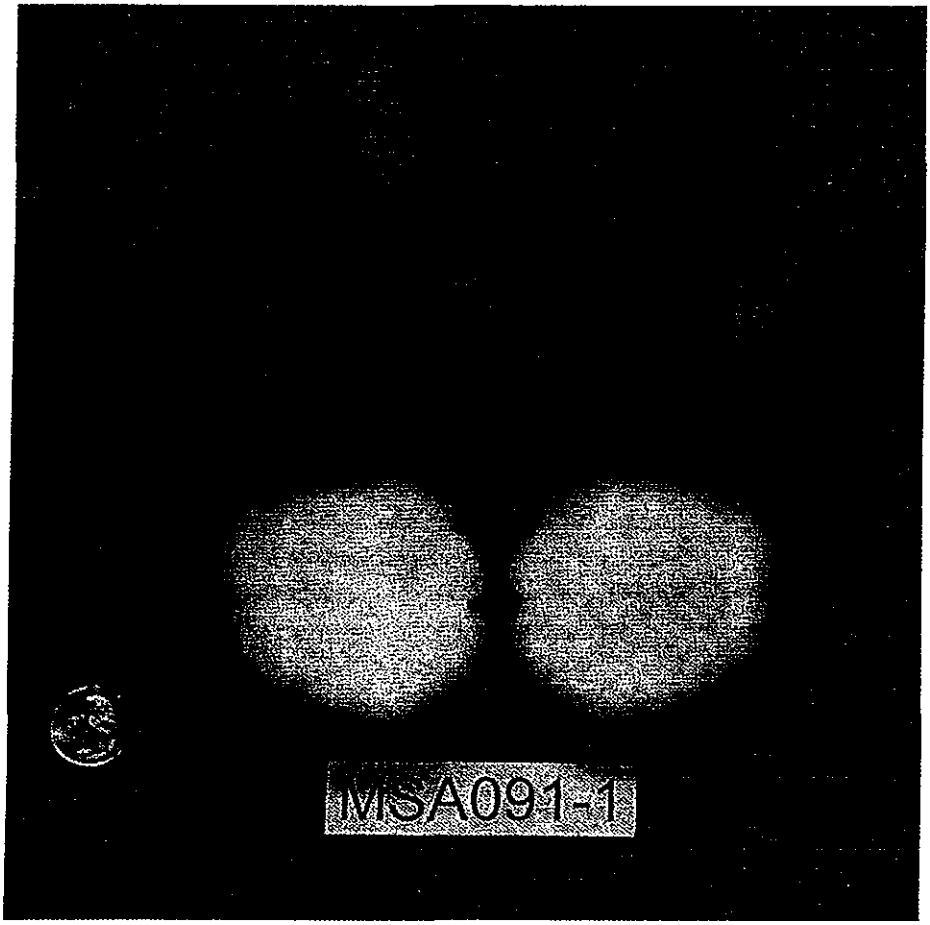


FIGURE 1.
Tuber sample of Liberator from field trial at Montcalm Potato Research Farm.

ible. *Stems:* Anthocyanin weak, wings are weak. *Leaves:* Yellow-green (Royal Horticulture Society [R.H.S.] Color Chart value 147A) with medium dense, short pubescence; closed leaf silhouette; petiole anthocyanin coloration is weak; leaf stipules are medium sized. *Terminal leaflets:* Narrowly ovate with acuminate tip and obtuse base, with slight leaflet margin waviness. *Primary leaflets:* Four pairs per leaf, narrowly ovate, with acuminate tip and obtuse base. *Secondary and tertiary leaflets:* six pairs. *Vine maturity:* full season.

Inflorescence: Three to eight with an average of six per plant; mean of 12 florets per inflorescence. *Corolla:* Semi-stellate in shape with a white color (R.H.S. Color Chart value155C). *Calyx:* Anthocyanin coloration absent. *Anthers:* Narrow cone shape with a yellow-orange color (R.H.S. Color Chart value 15A). *Stigma:* Capitate and green (R.H.S. Color Chart value 137C). *Fertility:* Pollen shed is abundant and female fertility is high. Berry set in the field is heavy.

Tubers: *Shape:* Round. The average tuber length x width x thickness is 83 mm x 70 mm x 56 mm with an average weight of 203 g. *Skin:* Bright and smooth with a buff color (R.H.S. Color Chart value 162C). *Eyes:* Intermediate eye depth, evenly distributed with an average 10 eyes/tuber; eyebrows have a slight prominence. *Flesh:* Cream (R.H.S. Color Chart value 11D). *Dormancy:* Comparable to Atlantic.

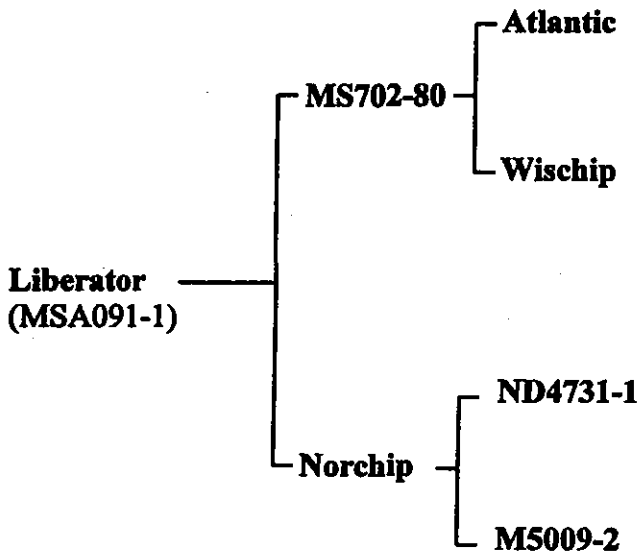


FIGURE 2.
Pedigree of Liberator.

DISEASE RESISTANCE

In Michigan there is a need for chip-processing varieties that have resistance to scab. Liberator was bred to combine scab resistance with chip-processing characteristics. Replicated field trials were conducted at the MSU Soils Farm Scab Nursery to assess resistance to common and pitted scab. This disease trial

TABLE 1—*Scab* (Streptomyces scabies) *disease reaction from the Scab Nursery at the Michigan State University Soils Farm, East Lansing, MI.*

Entry	1997[1]	1998[1]	1999[1]	2000[2]
Liberator	1.8	1.5	1.0	0.5
Atlantic	3.3	3.3	3.0	3.3
Snowden	2.5	3.5	3.0	3.0

[1]Scab Disease Rating
1: Practically No Infection
2: Low Infection
3: Avg. Susceptibility
4: High Susceptibility
5: Severe Susceptibility

[2]Scab Disease Rating
0: No Infection
1: Low Infection <5%
2: Moderate Susceptibility
3: Intermediate
4: High Susceptibility
5: Severe Susceptibility

is a severe test for scab susceptibility. From 1997 to 1999, the varieties were ranked on a 1-5 scale based upon a combined score for scab coverage and lesion severity. A rating of 1.0 indicates zero to a trace amount of infection. A moderate resistance (1.2 – 1.8) correlates with <10% infection and surface scab. These two categories are good levels of scab tolerance. Susceptible lines have > 25% infection with pitted lesions. Scores of 4.0 or greater are found on lines with >50% infection and severely pitted lesions. In 2000, the scale was modified to a 0-5 scale with 0 equal to no infection; 1 is a low infection (<5%); 3 is intermediate susceptibility; and >4 is highly susceptible. Table 1 compares Liberator to some check varieties. Based upon four years of trials, Liberator has resistance to scab that is superior to two chip-processing varieties, Atlantic and Snowden. Some check cultivars that sort into the resistant category are Russet Burbank, Pike, Onaway and Superior (data not shown).

As part of the post-harvest evaluation, resistance to *Fusarium sambucinum* (fusarium dry rot) was assessed by inoculating eight to 10 whole tubers post-harvest from each line. The tubers were held at 20 C for approximately 3 wk and then the width and depth of the dry rot lesions were measured. These data for Liberator, Snowden, and Atlantic are summarized in Table 2. Liberator is similar to Snowden in dry rot tolerance, while Atlantic is more susceptible and typical of other varieties. Tolerance to dry rot is based upon infection depth. Based upon previous tests, Russet Norkotah and Superior also have tolerance to fusarium dry rot (data not shown).

TABLE 2—*Reaction of potato tubers to Fusarium dry rot* (Fusarium sambucinum).

	Average Depth (mm)*		
Entry	1998	1999	2000
Liberator	4.8	7.8	10.7
Atlantic	17.5	16.6	14.2
Snowden	6.6	4.8	9.8
$LSD_{0.05}$	8.1	4.1	10.5

*Tubers were wounded, then inoculated with a plug of mycelium. After 3 weeks, the lession depth was measured.

Liberator was also evaluated for foliar susceptibility to late blight (*Phytophthora infestans* de Bary) and the tubers for erwinia soft rot (*Erwinia carotova*) response. Although resistance was not observed, the infection level was not unlike other varieties. Liberator does express PLRV and mosaic symptoms, but it has not been formally tested for its level of susceptibility. Observations during field seed increase or during agronomic trials did not indicate any unusual susceptibility to PVX, PVY, and PLRV.

AGRONOMIC PRODUCTION

Field experiments were conducted at the Montcalm Research Farm in Entrican, MI, to measure total and marketable yields, to determine tuber size distribution, specific gravity, and blackspot bruising, and to evaluate tuber appearance and incidence of external and internal defects. Liberator and other lines and check varieties were planted in a randomized complete block design with four replications. The plots were 7.01 m in length and spacing between plants was 30.5 cm. Inter-row spacing was 86.4 cm. Total nitrogen fertilization during the season was 200 kg/Ha. Supplemental irrigation was applied as needed. Yield was graded into four size classes, incidence of external and internal defects in >8.3-cm-diameter potatoes were recorded, and samples for specific gravity, chip-processing, dormancy, disease tests, and bruising tests were taken from 3.08 cm to 8.3 cm diameter potatoes.

Liberator's agronomic performance has been tested for more than four years at the Montcalm Research Farm under irrigated conditions, three years in the North Central Regional Trials, and two years in the National Snack Food Association Trials. Four years of full season agronomic data at the Michigan State University Montcalm Research Farm for Liberator in comparison to Atlantic and Snowden is summarized in Table 3. Tuber specific gravity of Liberator is slightly lower than Atlantic but comparable to Snowden. Under our trial conditions, the oversized tubers of Atlantic have a tendency to express hollow heart. Liberator is less susceptible to this condition. In the four years of

TABLE 3—*Agronomic performance trials at the Michigan State University Montcalm Research Farm, Entrican, Michigan.*

Year	Yield (mt/ha)		Percent of Total[1]					Specific Gravity	Tuber Quality[2]		Days to Harvest
	US#1	Total	US#1	Bs	As	OV	PO		HH	IBS	
						Liberator					
1997	20.0	25.9	77	21	75	2	2	1.083	0	0	127 days
1998	32.2	38.9	83	9	64	18	8	1.075	0	0	133 days
1999	22.1	30.6	72	22	72	0	6	1.080	0	1	140 days
2000	45.4	52.8	86	9	69	17	5	1.081	0	2	146 days
Mean	29.9	37.0	80	15	70	9	5	1.080	0	1	
						Atlantic					
1997	23.6	28.2	84	14	74	10	3	1.089	3	0	127 days
1998	45.1	49.7	91	8	77	13	1	1.081	5	0	133 days
1999	36.3	41.9	87	11	76	11	3	1.090	5	1	140 days
2000	46.8	53.9	87	7	59	27	6	1.086	8	2	146 days
Mean	38.0	43.4	87	10	72	15	3	1.087	5	1	
						Snowden					
1997	15.8	24.8	64	36	63	1	0	1.083	0	0	127 days
1998	37.5	43.8	86	14	80	6	1	1.075	2	0	133 days
1999	27.7	35.2	79	21	74	4	1	1.080	0	0	140 days
2000	41.5	46.8	89	11	78	11	0	1.085	1	0	146 days
Mean	30.6	37.6	80	21	74	6	1	1.081	1	0	

[1]Size Distribution: B: < 5.1 cm, A: 5.1 - 8.3 cm, OV: > 8.3 cm, PO: Pickouts
[2]Tuber Quality: HH: Hollow Heart, IBS: Internal Brown Spot; number of tubers with HH or IBS in 40 oversize (>8.3 cm) tubers.

TABLE 4—*Yield and specific gravity of Liberator from the North Central Regional Potato Trials.*

Entry	Yield (mt/ha)		Percent US#1	Specific Gravity	Maturity*
	US#1	Total			
			1998 - 4 Locations		
Liberator	41.2	45.2	88	1.086	3.4
Atlantic	39.9	46.4	89	1.091	3.5
Snowden	41.9	46.6	89	1.089	3.4
			1999 - 9 Locations		
Liberator	28.7	38.8	73	1.086	3.7
Atlantic	37.9	44.4	82	1.091	3.2
Snowden	37.4	43.5	84	1.087	4.0
			2000 - 5 Locations		
Liberator	42.3	46.2	91	1.089	3.4
Atlantic	44.2	47.7	92	1.091	3.3
Snowden	43.8	48.0	89	1.088	3.4

*Maturity Rating
Ratings: 1 - 5
1: Early (vines completely dead)
5: Late (vines fully green)

trials low percentages of cull tubers were observed (2%-8%). The majority of these tubers were misshapen. In the 1998 North Central Regional Trials with irrigation, Liberator's performance was similar to Snowden and Atlantic, but in 1999 the marketable yield was lower (73%) (Table 4). In both years, the vine maturity between varieties was similar. In the 1999 Snack Food Association Trials, Liberator had higher yield than Snowden and was comparable to Atlantic (Table 5). Liberator was included in on-farm trials in Michigan from 1997 to 2000. Table 6 summarizes the agronomic performance of four locations. It should be noted that agronomic performance of Liberator was only observed at irrigated sites with sandy loam soil types.

Chip-processing quality of Liberator was assessed on tubers from the North Central Regional Trials. Table 7A compares Liberator to Atlantic and Snowden. In 1998 the chip color of Liberator was equivalent to Atlantic and Snowden in out-of-the-field and 10 C storage samples, but darker than Snowden from 5.7 C storage (based on the average of four locations). In 1999, similar results were found from samples over eight locations. In the Michigan State University Trials and the Snack Food Associa-

TABLE 5—*Yield and specific gravity of Liberator from the Snack Food Association Trials.*

Entry	Yield (mt/ha) US#1	Yield (mt/ha) Total	Percent US#1	Specific Gravity
	1999[1]			
Liberator	43.4	50.2	88	1.081
Atlantic	44.7	49.9	90	1.085
Snowden	32.8	38.4	84	1.082
	2000[2]			
Liberator	37.1	42.5	88	1.082
Atlantic	39.8	44.2	91	1.086
Snowden	33.4	40.6	82	1.085

[1]Average of Six Locations: CA, FL, ME, MI, PA, and WA.
[2]Average of Six Locations: CA, FL, ME, MI, MN, and WA.

tion Trials, chip-processing quality was assessed on 25-tuber samples, taking two longitudinal slices from each tuber. Chips were fried at 185 C, and the color was measured with various colorimeters (i.e., Agtron, Hunter) or evaluated visually with the Snack Food Association 1-5 color chart. Tuber samples were also stored at 5.7 and 10 C for chip processing out of storage in January and April. In the MSU trials the chip color of Liberator was comparable to that of Atlantic and Snowden (both out of the field and out of storage) except that the chip color of Snowden samples stored at 5.7 C was lighter (data not shown). Table 7B shows the 1999 Snack Food Association chip processing results from out-of-the-field samples. Again chip color scores for Liberator were comparable to the checks. Figure 3 shows a sample of Liberator chips from long-term 9 C storage compared to Dakota Pearl from the 1999 SFA Trial in Michigan.

To evaluate blackspot bruise, two 25-tuber samples were collected (a composite of four replications) from each line and variety at the Montcalm Research Farm at the time of grading.

TABLE 6—*Yield and specific gravity of Liberator from on-farm processing potato trials.*

Entry	Yield (mt/ha) US#1	Yield (mt/ha) Total	Percent US#1	Specific Gravity
	1997 - 5 Locations			
Liberator	43.3	50.0	87	1.084
Atlantic	44.4	49.2	90	1.083
Snowden	44.7	49.7	91	1.085
	1998 - 4 Locations			
Liberator	32.1	37.4	84	1.077
Atlantic	41.5	47.0	88	1.079
Snowden	40.0	44.8	89	1.079
	1999 - 4 Locations			
Liberator	35.1	41.0	85	1.080
Atlantic	41.8	44.9	93	1.085
Snowden	35.0	42.4	82	1.081

TABLE 7A—*Chip color values from North Central Regional Trials.*

Entry	OTF[1] Hunter[2]	OTF Visual[3]	3 Months Storage 5.7°C Hunter	3 Months Storage 10°C Hunter
	1998 - 4 Locations			
Liberator	59	-	52	61
Atlantic	59	-	51	58
Snowden	61	-	59	62
	1999 - 8 Locations			
Liberator	63	1.5	52	60
Atlantic	61	1.8	51	59
Snowden	63	1.4	57	63
	2000 - 9 Locations			
Liberator	-	1.4	-	-
Atlantic	-	1.7	-	-
Snowden	-	1.1	-	-

[1]OTF: Out of the field.
[2]Hunter values provided by USDA-ARS-NPA Potato Research Worksite at East Grand Forks, MN.
[3]Visual Rating using the Snack Food Association Scale (1-5).

TABLE 7B—*Relative comparison of chip color values[1] from Snack Food Association Trials.*

Entry	Location Florida	Maine	Pennsylvania	Michigan	Washington
	1999				
Liberator	58	71	58	65	52
Atlantic	55	68	56	-	53
Snowden	61	67	60	64	42
	2000				
Liberator	60	71	62	61	-
Atlantic	60	68	59	63	-
Snowden	59	71	65	62	-

[1]Samples were chipped out of the field.

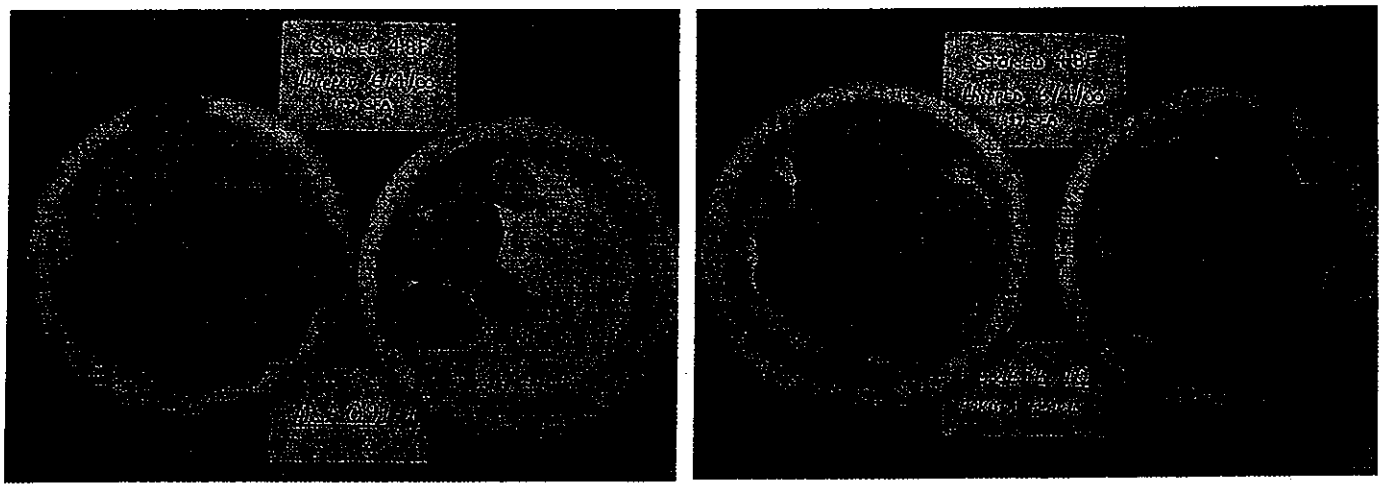


FIGURE 3.
1999-2000 SFA Chip Trial commercial storage samples of Liberator (MSA091-1) and Dakota Pearl. Tuber samples were stored at 48°F (9°C). Chips with internal or external defects (dish on the right) were separated from defect-free chips (dish on the left).

One sample was placed in 10 C storage overnight and then tumbled in a hexagon plywood drum 10 times to simulate bruise-conducive conditions. The other 25-tuber check sample was held at room temperature. After holding the samples at ambient indoor temperatures for 3 wk, the tubers were peeled in an abrasive peeler and individual tubers were assessed for the number of blackspot bruises on each potato. These data from 1998 and 2000 are shown in Table 8. The bruise data are represented in two ways: percentage of bruise-free potatoes and average number of bruises per tuber. Liberator has blackspot susceptibility similar to Atlantic and Snowden. This range of 0.9-1.2 bruises per tuber and 25%-40% bruise-free tubers are typical of an intermediate level of bruising in our procedure. Bruising levels of greater than 1.5 bruises per tuber and less than 20% bruise free are classified as more sensitive to bruising during handling. Each year a sample of tubers that are not tumbled as described above (check sample) are also evaluated for blackspot bruising. The incidence of blackspot bruising in the check sample was very low for Liberator (Table 8).

TABLE 8—*Black-spot bruise results of "A"-size tuber samples.*

	1998		1999		2000	
Entry	Avg. Spot Per Tuber	% Tubers Bruise Free	Avg. Spot Per Tuber	% Tubers Bruise Free	Avg. Spot Per Tuber	% Tubers Bruise Free
	Check Samples[1]					
Liberator	0.0	96	0.4	72	0.5	60
Atlantic	0.0	96	1.3	41	0.7	52
Snowden	0.0	100	0.1	88	0.3	69
	Simulated Bruise[2]					
Liberator	1.0	37	1.4	22	1.2	36
Atlantic	1.2	48	2.0	20	1.1	41
Snowden	0.9	30	1.1	33	1.1	24

[1]Tuber samples were collected at harvest, graded, and held until evaluation. Samples were abrasive-peeled and scored.
[2]Tuber samples were collected at harvest, held at 10 C at least 12 hr, and placed in a six-sided plywood drum and rotated ten times to produce simulated bruising. Samples were abrasive-peeled and scored.

ELECTROPHORETIC PATTERNS

Leaf tissue was sampled from Liberator to construct an electrophoretic fingerprint. The procedures and allelic designations used are according to Douches and Ludlam (1991). The transcript for 10 enzyme loci is described below:

Mdh-1^2*1*^{2}*1*^{2}*1*^{4}, *Mdh-2*^{2}*2*^{2}*2*^{2}*2*^{2}, *6-Pgdh-3*^{1}*3*^{1}*3*^{2}*3*^{2}, *Idh-1*^{1}*1*^{2}*1*^{2}*1*^{2}, *Pgi-1*^{2}*1*^{2}*1*^{2}*1*^{4}, *Got-1*^{3}*1*^{3}*1*^{4}*1*^{4}, *Got-2*^{3}*2*^{3}*2*^{5}*2*^{5}, *Pgm-1*^{1}*1*^{1}*1*^{1}*1*^{2}, *Pgm-2*^{2}*2*^{2}*2*^{2}*2*^{3}, *Dia-1*^{1}*1*^{1}*1*^{1}*1*^{2}.

This electrophoretic data is maintained as part of a database with over 200 lines and varieties. The electrophoretic fingerprint is unique to Liberator.

CHEMISTRY

Total tuber glycoalkaloids (TGA) were measured on tubers collected at harvest from 1997 to 2000. These samples were sent to either Dr. Ken Deahl at the

TABLE 9—*Total glycoalkaloids*[1] *(mg / 100g FW) from fall-harvested tubers.*

Entry	1998[2]	1999[3]	2000[2]	Avg.
Liberator	8.7	3.7	4.6	5.7
Atlantic	9.5	1.9	11.4	7.6

[1]Solid phase/ion pairing extraction (C18) HPLC/PDA detection
[2]Perkins - Maine
[3]USDA-ARS - Deahl

USDA/ARS/PSI Vegetable Laboratory or to Brian Perkins at the University of Maine Food Safety Laboratory for analysis. For these TGA analyses the extraction and rapid high-performance liquid chromatographic determination method was used (Carman et al. 1986). Table 9 summarizes the TGA data for Liberator along with Atlantic for 1998-2000. In each year the level of TGA was well within the acceptable range (below 20 mg TGA/100 g fresh wt.).

SEED AVAILABILITY

Virus-free tissue culture plantlets of Liberator were sent to Sklarczyk Seed Farm (8714 M32 East, Johannesburg, MI 49751; phone: 517-731-5452) and Krueger Seed Farm (2797 W. Hawkes Hwy., Hawks, MI 49743; phone: 517-734-7366). Small amounts of seed for testing can be obtained from Dave Douches at Michigan State University (517-355-6887, douchesd@msu.edu). Plant Variety Protection is being applied for Liberator.

ACKNOWLEDGMENTS

The development and testing of Liberator was supported in part by the Michigan Agricultural Experiment Station, Michigan Potato Industry Commission and the USDA Special Grant for Potato Breeding/Variety Development. Chris Long, Lynn Buzka, Kim Felcher, and Jarred Driscoll provided technical support.

LITERATURE CITED

Carman. A.S. S.S. Shia, G.M. Ware, O.J. Francis and G.P. Kirschenheuter. 1986. Rapid High-performance liquid chromatographic determination of the potato glycoalkaloids ∝-solanine and ∝-chaconine. J Agric Food Chem 34:279-282.

Douches, D.S., and K. Ludlam. 1991. Electrophoretic characterization of North American potato varieties. Am Potato J 68:767-780.

Johansen, R.H., J.T. Schulz, and J.E. Huguelet. 1969. Norchip: A new early maturing chipping variety with high total solids. Am Potato J 46:254-258.

REPRODUCE LOCALLY. Include form number and edition date on all reproductions. FORM APPROVED - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
Michigan State University	MSA091-1	Liberator
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*	**5. TELEPHONE** *(Include area code)*	**6. FAX** *(Include area code)*
109 Agriculture Hall Michigan State University East Lansing, MI 48824	(517) 355-0123	(517) 353-5406
	7. PVPO NUMBER #200200168	

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☑ **YES** ☐ **NO**

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** ☑ **YES** ☐ **NO**

10. Is the applicant the original owner? ☑ **YES** ☐ **NO** **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☐ **YES** ☐ **NO** **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☐ **YES** ☐ **NO** **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

'Liberator' was developed by a team of plant scientists in several departments under the Michigan Agricultural Experiment Station at Michigan State University. The ownership rights are the property of Michigan State University.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT F
DECLARATION REGARDING DEPOSIT

NAME OF OWNER (S)	ADDRESS *(Street and No. or RD No., City, State, and Zip Code and Country)*	TEMPORARY OR EXPERIMENTAL DESIGNATION
Michigan State University	109 Agriculture Hall Michigan State University East Lansing, MI 48824 USA	MSA091-1 **VARIETY NAME** Liberator
NAME OF OWNER REPRESENTATIVE (S)	**ADDRESS** *(Street and No. or RD No., City, State, and Zip Code and Country)*	[redacted]
Michigan State University	109 Agriculture Hall Michigan State University East Lansing, MI 48824 USA	**PVPO NUMBER** #200200168

I do hereby declare that during the life of the certificate a viable sample of propagating material of the subject variety will be deposited, and replenished as needed periodically, in a public repository in the United States in accordance with the regulations established by the Plant Variety Protection Office.

D L S. D

Signature

Feb 27, 2007

Date